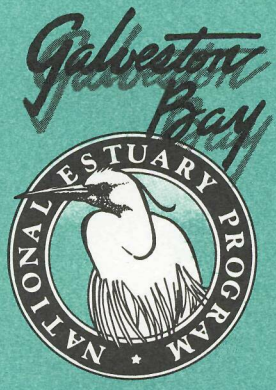
Characterization of Selected Public Health Issues in Galveston Bay



Galveston Bay
National Estuary Program
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Characterization of Selected Public Health Issues in Galveston Bay

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Characterization of Selected Public Health Issues in Galveston Bay

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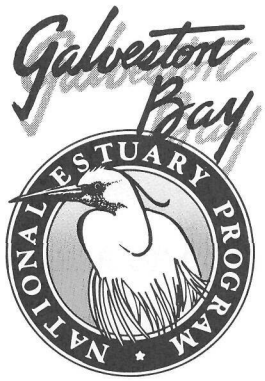

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EXECUTIVE SUMMARY

The purpose of this project is to characterize public health issues associated with bay use activities such as shellfish consumption and contact and non-contact recreation. The major objectives of this characterization study are:

1. Review and summarize activities associated with shellfish bed closures,
2. Identify and characterize sources of bacterial contamination,
3. Review and characterize areas of Galveston Bay which have exceeded water quality standards for contact and non-contact recreation, and
4. Assess the incidence of known pathogenic organisms such as Vibrio Vulnificus.

The characterization includes consideration of indicator organisms and known pathogenic organisms and covers all identified water quality segments of Galveston Bay.

The report is an analysis of existing data obtained from agencies involved with public health protection and regulation--the Texas Department of Health (TDH) and the Texas Water Commission (TWC) as well as information provided by Galveston and Harris counties, the City of Houston, and numerous other sources. There are six major sections in this report. The first is is an introduction which provides an overview of the project. The second section briefly introduces and compares indicator organisms used by various agencies, and their relation with pathogens. The EPA and Texas water quality criteria for indicator organisms are reviewed as well as a brief historical review of the National Shellfish Sanitation Program (NSSP). A more detailed analysis of the TDH implementation of the NSSP is the subject of Section 3.0. Section 4.0 focuses on sources of bacterial input to Galveston Bay. The objective is to analyze and quantify to the extent practical the contribution of indicator organisms to Galveston Bay from a range of sources. Section 5.0 is an analysis of available indicator organism data, including spatial and temporal patterns. Section 6.0 describes an investigation of the possible relationship between indicator organism levels and known pathogenic microorganisms in Galveston Bay. Among the pathogens, Vibrios are of primary concern because of their medical significance and their ability to be transmitted through various contact and noncontact recreational activities as well as the consumption of seafood.

The major conclusions, described in more detail in each section, include:

1. While many changes have taken place over the years in shellfish harvesting regulation, there have been no major changes in the areas closed to shellfish

harvesting. Analyses on the coliform data show that many areas classified as "polluted" or closed to shellfish harvesting do not have high long-term mean indicator levels. The classification is generally a result of either a small portion of the data exceeding higher values, generally after rains, or a judgement made about the potential for upland facilities to introduce pathogens.

2. All open bay areas of Galveston Bay conform to current Texas water quality criteria for contact recreation. The only areas whose overall long-term median FC levels exceed the 200 col/dL contact recreation criteria are inland areas: Houston Ship Channel, Houston area bayous (Greens, Sims, Hunting, Brays, Buffalo, Clear Creek), Dickinson Bayou and Bastrop Bayou Tidal.

3. From admittedly noisy coliform bacteria data, which are available back to roughly 1950, no change could be detected over time that could be associated with watershed development activities.

4. As an indicator of the possible presence of human wastes and thus diseases associated with human waste, the total and later FC bacteria tests have a long and quite successful history. However, over the last several decades, it is becoming increasingly obvious that the tests have numerous limitations. These include frequent "false positives" - essentially naturally occurring bacteria which "pass" the test, failure to correlate with pathogens directly measured in some studies, and failure to provide an alert for naturally occurring pathogenic microorganisms.

5. Among the sources of indicator bacteria loadings to the Galveston Bay, wet weather runoff contributes the most significant amount. However, due to the die-off rate of bacteria, high concentrations in the bay tend to be localized and of short duration.

6. No significant correlation between indicator bacteria levels and incidents of Vibrio diseases could be found in the data.

1.0 INTRODUCTION

The purpose of this project is to characterize public health issues associated with bay use activities such as shellfish consumption and contact and non-contact recreation. The major objectives of this characterization study are:

1. Review and summarize activities associated with shellfish bed closures,

2. Identify and characterize sources of bacterial contamination,

3. Review and characterize areas of Galveston Bay which have exceeded water quality standards for contact and non-contact recreation, and

4. Assess the incidence of known pathogenic organisms such as Vibrio Vulnificus.

The characterization includes consideration of indicator organisms and known pathogenic organisms and covers all identified water quality segments of Galveston Bay. Existing data that were employed in this work included:

Texas Department of Health (TDH)

- Indicator bacteria data computer files and paper listings,
- Shellfish classification maps showing each change in Shellfish harvesting area boundaries, and
- Files of Vibrio and other pathogen identifications;

Texas Water Commission (TWC)

- Machine readable copy of Statewide Monitoring Network (SMN) data (coliforms, temperature, salinity) for selected stations in the bay, along with paper copy of above for data checking, and
- Paper listing of files for all permitted point sources discharging to the listed bay segments.

There are six major sections in this report. The first is this introduction which provides an overview of the project. The second section briefly introduces and compares indicator organisms used by various agencies, and their relation with pathogens. In addition, the Environmental Protection Agency (EPA) and Texas water quality criteria for indicator organisms are reviewed. A brief historical review of the National Shellfish Sanitation Program (NSSP) concerning the use of indicator organisms for the classification of shellfish growing waters is also included in Section 2.

Section 3 of this report summarizes the TDH implementation of the requirements of the NSSP for segments in Galveston Bay. The objective is to review current and historical regulations and shellfish classification boundaries. The review included:

1. TDH regulatory procedures (NSSP),
2. historical maps showing prohibited shellfish growing areas,
3. trends of bay areas in terms of prohibited, conditionally approved, and approved growing areas,
4. differences in prohibited areas with change from total to fecal coliform as regulatory criteria,
5. current classifications of bay areas,
6. TDH monitoring and management practices,
7. a comparison of measurement techniques for coliform bacteria, and
8. comparison of the Texas program with those in other coastal states.

Section 4 focuses on sources of bacterial input to Galveston Bay. The objective is to analyze and quantify to the extent practical the contribution of indicator organisms to Galveston Bay from a range of sources. The sources considered include:

1. permitted wastewater discharges,
2. wastewater collection system leaks, overflows and excursions,
3. partially treated wastewaters from failed septic systems, and
4. runoff from watershed areas.

Section 5 documents results from analyzing both total and FC data from the TDH, TWC and predecessor agencies, including the Texas Water Quality Board (TWQB, the old Galveston Bay Project) for the Galveston Bay system. This section starts with a brief description of the sub-segmentation of the Galveston Bay segments into quadrilaterals. Statistical and regressional analyses on the historical coliform data and comparisons are described with various indicator bacteria criteria. The relationship between total and FC was investigated based on long-term geometric means of the data. Finally, the collected coliform data are used to investigate possible temporal trends for several representative quadrilaterals in the open bay areas.

Section 6 describes an investigation of the possible relationship between indicator organism levels and known pathogenic microorganisms in Galveston Bay. Among the pathogens, Vibrios are of primary concern because of their medical significance and their ability to be transmitted through various contact and noncontact recreational activities as well as the consumption of seafood. The first part of this section is a description of Vibrio bacteria. Next, data obtained from TDH on the incidents of Vibrio infections in Texas were analyzed and reported. The relationship between these incidents and FC data was then

explored. Finally, brief investigation was performed to determine the existence of data about other known diseases which are associated with shellfish consumption.

There are two appendices attached to this report. The first is a copy of the available historical shellfish classification maps published by TDH. The second is a detailed description of indicator organism testing procedures. The shellfish classification maps in ARC-INFO format are provided to the GBNEP in diskettes under separate cover.